

Appl. No. 10/804,758  
Supplemental Amdt. dated June 15, 2007  
Supplementing Amdt. dated April 26, 2007  
Reply to Office action of January 26, 2007

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Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1. (currently amended) A sensor system for controlling a vehicle steering control system comprising:

a plurality of global navigation satellite sensor systems (GNSS) system  
including receivers a receiver and multiple antennas connected to said receiver at a fixed spacing and configured to determine a vehicle position, velocity, heading angle and roll angle based on carrier phase corrected real time kinematic (RTK) position differences, and configured to derive vehicle position and velocity based on code and/or carrier phase observations, at least one of said antennas having a fixed offset to ground;

wherein said roll angle facilitates correction of lateral motion induced cross-track position errors resultant from motion of said antennae as said vehicle moves based on said offset to ground and said roll angle; and

a yaw gyroscope configured to derive a rate of change of the heading angle;

a roll gyroscope configured to derive a rate of change of the roll angle; and

a control system connected to said GNSS system and including a microprocessor controller configured to: 1) receive said GNSS-derived vehicle position, velocity, heading angle, and roll angle and said gyroscope-derived heading and roll angle rates of change, 2) integrate said GNSS-derived heading and roll angles with said gyroscope-derived heading and roll angle rates of change, 3) correct lateral

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motion induced cross-track position errors resultant from motion of said antenna as said vehicle moves based on said offset to ground and said roll angle, and 4) configured to generate a steering command to [[a]] the vehicle steering system based on said GNSS-derived and gyroscope-derived vehicle operating conditions and said lateral motion correction.

Claim 2. (original) The sensor system of Claim 1 wherein said steering command is based on a cross-track error to at least one of a desired path, trajectory, and location and said vehicle heading angle.

Claim 3. (original) The sensor system of Claim 2 wherein said control system employs at least one of said cross-track error, a heading error, rate of change of cross-track error, rate of change of heading, vehicle forward velocity, and combinations thereof to formulate said steering command.

Claim 4. (currently amended) The sensor system of Claim 1, further including [[a]] said yaw rate gyro to provide gyroscope deriving a rate of turn with reduced noise and more rapid response over as compared to a rate of turn computed from said GNSS based heading angle.

Claim 5. (currently amended) The sensor system of Claim 1, further including [[a]] said roll rate gyro to provide gyroscope deriving a roll rate with reduced noise and more rapid response over as compared to a roll rate computed from said GNSS based roll angle.

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Claim 6. (currently amended) The sensor system of Claim 1 wherein said antennae and said ~~receivers~~ receiver are enclosed in a single enclosure.

Claim 7. (currently amended) The sensor system of Claim 6, further including at least one of [[a]] said yaw rate-gyre gyroscope and [[a]] said roll rate-gyre gyroscope in said enclosure.

Claim 8. (currently amended) The sensor system of Claim 1, wherein said GNSS includes at least one of global positioning system (GPS), differential global positioning system (DGPS), Global Navigation System (GLONAS), Wide Area Augmentation System (WAAS) and real-time kinematic (RTK) and combinations including at least one of global positioning system (GPS), differential global positioning system (DGPS), Global Navigation System (GLONAS), Wide Area Augmentation System (WAAS) and real-time kinematic (RTK).

Claim 9. (previously presented) The sensor system of Claim 6, further including a mounting base configured to mount said enclosures and provide an unimpeded view to satellites of said GNSS.

Claim 10. (currently amended) A method for computing a position of a vehicle comprising:

initializing a global navigation satellite sensor ~~systems~~ (GNSS) system;  
computing a first position of a first GNSS antenna of said GNSS system on said vehicle;

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computing a second position of a second GNSS antenna of said GNSS system on said vehicle at a fixed spacing relative to said first antenna;

at least one of said antennas having a fixed offset to ground;

calculating a vehicle heading angle and roll angle based on carrier phase

differences;

calculating a vehicle position and velocity based on code and/or carrier phase observations,

calculating a heading as a vector perpendicular to a vector joining said first position and said second position, in a horizontal plane aligned with said vehicle;

deriving a rate of change of the heading angle with a yaw gyroscope;

deriving a rate of change of the roll angle with a roll gyroscope;

computing a roll angle of said vehicle as an arc-tangent of a ratio of differences in heights of said first GNSS antenna and said second GNSS antenna divided by a spacing between their respective phase centers;

providing a control system with a microprocessor controller and connecting said GNSS system to said control system;

receiving with said microprocessor controller said GNSS-derived vehicle position, velocity, heading angle and roll angle and said gyroscope-derived heading and roll angle rates of change;

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integrating with said microprocessor controller said GNSS-derived heading and roll angles with said gyroscope-derived heading and roll angle rates of change; and

correcting with said microprocessor controller for crosstrack errors by calculating an actual position at a center of said vehicle projected to ground using said computed roll angle and a known height from said ground of at least one of said first GNSS antenna and said second GNSS antenna.

Claim 11. (original) The method of Claim 10, further including computing another position of another GNSS antenna, and computing a pitch angle and another roll angle.

Claim 12. (canceled)

Claim 13. (canceled)